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# BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/775,911
Filing Date: February 10, 2004
Appellant(s): MORGAN, DENNIS R.

Kevin M. Mason
For Appellant

# EXAMINER'S ANSWER

This is in response to the appeal brief filed 30 April 2010 appealing from the Office action mailed 5 January 2010.

**(1) Real Party in Interest**

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The following is a list of claims that are rejected and pending in the application:

Claims 1-5, 7-11 and 13-22.

**(4) Status of Amendments After Final**

The examiner has no comment on the appellant’s statement of the status of amendments after final rejection contained in the brief.

**(5) Summary of Claimed Subject Matter**

The examiner has no comment on the summary of claimed subject matter contained in the brief.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

**(7) Claims Appendix**

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant’s brief.

**(8) Evidence Relied Upon**

| | | |
|---|---|---|
| 6,687,461 | MacFarlane et al. | 2-2004 |

Madsen et al.; "Optical filter architecture for approximating any 2 x 2 unitary matrix," Optics Letters, vol. 28, no. 17, April 1, 2003, pages 534-536.

Eyal. et al.; "Design of Broad-Band PMD Compensation Filters," IEEE Photonics Technology Letters, vol. 14, no. 8, August 2002, pages 1088-1090.

Applicant's Admitted Prior Art: the applicant's figures 1-3 and specification page 3 lines 3-32 and page 4 lines 1-4.

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

**Claims 1-4 and 13-16** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Madsen et al.** ("Optical filter architecture for approximating any 2 x 2 unitary matrix," Optics Letters, vol. 28, no. 17, April 1, 2003, pages 534-536) in view of **MacFarlane et al.** (US 6,687,461 B1).

Regarding **claim 1**, Madsen et al. disclose a method for compensating for polarization mode dispersion in an optical fiber communication system (Figures 1-3), comprising the steps of:

reducing the polarization mode dispersion using a cascade of two-port all-pass filters (see Abstract and Figure 3); and

adjusting coefficients of the two-port all-pass filters (see page 535, left column, first complete paragraph), wherein said adjusting step is performed by a device (fig. 1 and page 534 col. 1 second paragraph).

Regarding **claim 13**, as similarly discussed above with regard to claim 1, Madsen et al. disclose a polarization mode dispersion compensator in an optical fiber communication system, comprising:

a cascade of two-port all-pass filters having coefficients that are adjusted (again, see Abstract, Figure 3, and page 535, left column, first complete paragraph) wherein said adjustment is performed by a device (fig. 1 and page 534 col. 1 second paragraph).

Regarding claims 1 and 13, Madsen et al. disclose a cascade of two-port all-pass filters insofar as they disclose all-pass filters having two ports which are cascaded together (Figure 3 of Madsen et al. shows a cascade of two-port all-pass filters similar to that shown Applicant's Figure 4). Further regarding claims 1 and 13, Madsen et al. disclose adjusting the coefficients using a least squares algorithm (see page 535, left column, first complete paragraph) but do not specifically disclose adjusting the coefficients using a least mean square algorithm.

However, various optimization algorithms are well known in the signal processing and communication arts, and MacFarlane et al. in particular teach a system that is related to the one described by Madsen et al. including optical filters for compensating polarization mode dispersion having adjusted coefficients (column 1, lines 28-53; column 2, lines 51-65; column 5, lines 23-42). MacFarlane et al. specifically teach that the apparatus compensates signal irregularities “including chirp, polarization, and frequency dispersion” (column 1, lines 43-46). MacFarlane et al. further teach that the filter coefficients may be adjusted using a variety of minimization algorithms, including a least squares algorithm or a least mean square algorithm (column 19, lines 16-22).

Regarding claims 1 and 13, it would have been obvious to a person of ordinary skill in the art to specifically use a least mean square algorithm as taught by MacFarlane et al. in the system disclosed by Madsen et al. as an engineering design choice of another way to provide the minimization function already disclosed by Madsen et al. (Madsen et al., page 535, left column, first complete paragraph) and thereby effectively adjust the filter coefficients to quickly and accurately compensate dispersion. Both Madsen et al. and MacFarlane et al. teach various algorithms for performing a minimizing function, and it would have been obvious to a person of ordinary skill in the art to substitute one minimization algorithm for another to achieve a predictable result of optimizing the filter coefficient values. Furthermore, MacFarlane et al. particularly teach the substitution of least mean square algorithm for a least squares algorithm (column 19, lines 16-22).

Regarding **claims 2 and 14**, Madsen et al. disclose that the cascade of two-port all-pass filters comprises a two-channel structure consisting of multiple cascades of all-pass filters and directional couplers (Figure 3).

Regarding **claims 3 and 15**, Madsen et al. disclose that the coefficient values are adjusted to minimize a cost function (page 535, left column, first complete paragraph). Examiner notes that MacFarlane et al. also teach adjusting filter coefficients to minimize a cost function (column 19, lines 16-22).

Regarding **claims 4 and 16**, Madsen et al. disclose measuring the polarization mode dispersion in a received optical signal (using the “estimate channel” element shown in Figure 1; see also page 534, left column, second complete paragraph).

**Claims 5 and 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Madsen et al.** in view of **MacFarlane et al.** as applied to claims 4 and 16 respectively above, and further in view of **Applicant’s Admitted Prior Art.**

Regarding **claims 5 and 17**, Madsen et al. in view of MacFarlane et al. describe a system and a method as discussed above with regard to claims 4 and 16 respectively, including a step of measuring the polarization mode dispersion in a received optical signal. They do not specifically suggest that the measuring step employs a tunable narrowband optical filter to render information from energy detector measurements.

However, Applicant's Admitted Prior Art (Applicant's Figures 1-3) suggests a system that is related to the one described by Madsen et al. in view of MacFarlane et al., including a polarization mode dispersion compensator 110 and a channel estimate element 300 for measuring polarization mode dispersion in a received optical signal (Applicant's specification, page 3, lines 3-25). Applicant's Admitted Prior Art further suggests that the measuring step employs a tunable narrowband optical filter 304 to render information from energy detector measurements (see Applicant's Figure 3 and specification, page 3, lines 26-32 and page 4, lines 1-4).

Regarding claims 5 and 17, it would have been obvious to a person of ordinary skill in the art to include a tunable narrowband optical filter as taught by Applicant's Admitted Prior Art in the system described by Madsen et al. in view of MacFarlane et al. in order to effectively provide the polarization mode dispersion measurement already disclosed by Madsen et al. and thereby enable the filters to compensate for the dispersion accurately.

**Claims 7-10 and 18-21** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Madsen et al.** ("Optical filter architecture for approximating any 2 x 2 unitary matrix," Optics Letters, vol. 28, no. 17, April 1, 2003, pages 534-536) in view of **Eyal. et al.** ("Design of Broad-Band PMD Compensation Filters," IEEE Photonics Technology Letters, vol. 14, no. 8, August 2002, pages 1088-1090).

Regarding **claim 7**, Madsen et al. disclose a method for compensating for polarization mode dispersion in an optical fiber communication system (Figures 1-3), comprising the steps of:

reducing the polarization mode dispersion using a cascade of two-port all-pass filters (see Abstract and Figure 3); and

adjusting coefficients of the two-port all-pass filters (see page 535, left column, first complete paragraph), wherein said adjusting step is performed by a device (fig. 1 and page 534 col. 1 second paragraph).

Regarding **claim 18**, as similarly discussed above with regard to claim 7, Madsen et al. disclose a polarization mode dispersion compensator in an optical fiber communication system, comprising:

a cascade of two-port all-pass filters having coefficients that are adjusted (again, see Abstract, Figure 3, and page 535, left column, first complete paragraph), wherein said adjusting step is performed by a device (fig. 1 and page 534 col. 1 second paragraph).

Regarding claims 7 and 18, Madsen et al. disclose a cascade of two-port all-pass filters insofar as they disclose all-pass filters having two ports which are cascaded together (Figure 3 of Madsen et al. shows a cascade of two-port all-pass filters similar to that shown Applicant's Figure 4). Further regarding claims 7 and 18, Madsen et al. disclose adjusting the coefficients using a least squares algorithm (see page 535, left column, first complete paragraph) but do not specifically disclose adjusting the coefficients using a Newton algorithm.

However, various optimization algorithms are well known in the signal processing and communication arts, and Eyal. et al. in particular teach a system that is related to the one described by Madsen et al. including optical filters for compensating polarization mode dispersion having adjusted coefficients (page 1088). Eyal et al. further teach that the filter coefficients may be adjusted using a Newton algorithm (page 1089, see particularly the end of the first paragraph of the right column).

Regarding claims 7 and 18, it would have been obvious to a person of ordinary skill in the art to specifically use a Newton algorithm as taught by Eyal et al. in the system disclosed by Madsen et al. as an engineering design choice of another way to provide the minimization function already disclosed by Madsen et al. (Madsen et al., page 535, left column, first complete paragraph) and thereby effectively adjust the filter coefficients to quickly and accurately compensate dispersion. Both Madsen et al. and Eyal et al. teach various algorithms for performing a minimizing function, and it would have been obvious to a person of ordinary skill in the art to substitute one minimization algorithm for another to achieve a predictable result of optimizing the filter coefficient values.

Regarding **claims 8 and 19**, Madsen et al. disclose that the cascade of two-port all-pass filters comprises a two-channel structure consisting of multiple cascades of all-pass filters and directional couplers (Figure 3).

Regarding **claims 9 and 20**, Madsen et al. disclose that the coefficient values are adjusted to minimize a cost function (page 535, left column, first

complete paragraph). Examiner notes that Eyal et al. also teach adjusting filter coefficients to minimize a cost function (page 1089).

Regarding **claims 10 and 21**, Madsen et al. disclose measuring the polarization mode dispersion in a received optical signal (using the “estimate channel” element shown in Figure 1; see also page 534, left column, second complete paragraph).

**Claims 11 and 22** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Madsen et al.** in view of **Eyal et al.** as applied to claims 7 and 18 respectively above, and further in view of **Applicant’s Admitted Prior Art.**

Regarding **claims 11 and 22**, Madsen et al. in view of Eyal et al. describe a system and a method as discussed above with regard to claims 7 and 18 respectively, including a step of measuring the polarization mode dispersion in a received optical signal. They do not specifically suggest that the measuring step employs a tunable narrowband optical filter to render information from energy detector measurements.

However, Applicant’s Admitted Prior Art (Applicant’s Figures 1-3) suggests a system that is related to the one described by Madsen et al. in view of Eyal et al., including a polarization mode dispersion compensator 110 and a channel estimate element 300 for measuring polarization mode dispersion in a received optical signal (Applicant’s specification, page 3, lines 3-25). Applicant’s Admitted Prior Art further suggests that the measuring step employs a tunable narrowband

optical filter 304 to render information from energy detector measurements (see Applicant's Figure 3 and specification, page 3, lines 26-32 and page 4, lines 1-4).

Regarding claims 11 and 22, it would have been obvious to a person of ordinary skill in the art to include a tunable narrowband optical filter as taught by Applicant's Admitted Prior Art in the system described by Madsen et al. in view of Eyal et al. in order to effectively provide the polarization mode dispersion measurement already disclosed by Madsen et al. and thereby enable the filters to compensate for the dispersion accurately.

**(10) Response to Argument**

In the Arguments page 4 line 22 to page 5 line 3, page 9 lines 1-8 and lines 20-23, and page 10 lines 1-9, the appellant argues that a person of ordinary skill in the art would not recognize how to adapt two-port all-pass filters using the LMS algorithm (i.e. that a person of ordinary skill in the art would not know how to use the LMS algorithm of MacFarlane in place of the LS algorithm of Madsen, as described in the obviousness rejection above) for the following reasons: 1) that it is not known to adapt two-port all-pass filters using the LMS algorithm, and 2) that the adaptation equations for FIR filters and/or single-channel filters do not apply to the adaptation of two-port all-pass filters.

The first reason amounts to arguing that a person of ordinary skill would not recognize how to adapt two-port all-pass filters using the LMS algorithm because of a failure of the prior art to *anticipate* such an adaptation. However,

this argument is not persuasive because anticipation is not required for a proper obviousness rejection under 35 USC § 103.

The second reason amounts to arguing that a person of ordinary skill would not recognize how to adapt two-port all-pass filters using the LMS algorithm because LMS algorithms are for FIR and/or single channel filters and do not apply to two-port all-pass filters. To support this argument, the appellant asserts that section III of the "Adaptive Algorithms" paper (provided by appellant, dated September 23, 2002) establishes that the LMS and Newton algorithms are for FIR filters and/or single-channel all-pass filters and are not useful for adapting two-port all-pass filters and also describes a derivation of equations for adapting two-port all-pass filters using the LMS algorithm or the Newton algorithm (see the Arguments page 5 lines 4-27). However, the paper does not in any way tie down the LMS and Newton algorithms to FIR filters and/or single-channel filters. Further, the paper's derivation of equations for making the LMS and Newton algorithms applicable to two-port all-pass filters is not evidence that the LMS and Newton algorithms are everywhere else inapplicable to two-port all-pass filters. Thus, since the paper does not provide support for the conclusion of the argument, the argument is not persuasive because it merely includes the conclusion in the premise, without other evidence for the conclusion.

In the Arguments page 5 line 28 to page 6 line 3 and page 6 lines 7-12, the appellant also argues that persons of ordinary skill in the art would be inclined to use FIR filters and would not be motivated to use two-port all-pass filters, for the reasons that a two-port all-pass filter is complex and not

advantageous, that an FIR filter is easier to implement, and that persons of ordinary skill in the art would not be motivated to utilize a two-port all-pass filter in the manner suggested by the Examiner. This argument is not persuasive. Madsen, the primary reference, already expressly discloses a two-port all-pass filter, thus the use of one is not at issue.

In the Arguments page 5 lines 3-6, the appellant argues that since the algorithms do not apply to the adaptation of two-port all-pass filters, the combination would not work. This argument is not persuasive because the appellant did not persuasively argue that the algorithms do not apply, as explained above, thus the reason the appellant gives for why the combination would not work is invalid.

In the Arguments page 6 line 13 to page 7 line 5 and page 7 line 29 to page 8 line 5, the appellant presents arguments for claims 7 and 18. These claims call for the Newton algorithm instead of the LMS algorithm of claims 1 and 13. However, the appellant's arguments for these Newton algorithm claims are the same as the arguments for the LMS algorithm claims. Thus, the arguments are not persuasive for the same reasons that the LMS algorithm arguments are not persuasive.

In the Arguments page 7 lines 6-13, page 8 lines 6-8 and lines 28-31, the appellant argues that while MacFarlane established a need for compensation of irregularities, including PMD, in the background section, MacFarlane's does not disclose or suggest fulfilling this need. This argument is not persuasive. MacFarlane's signal processing filter is presented as a solution in the context of

the issues presented in the background section, including the need for compensation of irregularities that include PMD. Further, Madsen already provides the PMD compensation teaching, and MacFarlane is nevertheless disclosing a least mean squares algorithm as an alternative to a least squares algorithm for minimizations.

In the Arguments page 7 lines 14-28, the appellant argues that the cited portion of Eyal does not teach that filter coefficients are adjusted using a Newton algorithm, arguing that the Newton adjustments cited are directed to the correction of optimization variables that are distinct from the coefficients in the preceding discussion of the same paragraph. However, the optimization variables of Eyal are effectively filter coefficients for the compensating filter, regardless of Eyal's use of the term "coefficient" for other designations (i.e. Fourier coefficients). The appellant argues that there is no rationale in apparently disregarding Eyal's teachings regarding the term coefficient; however, Eyal's express use of the term for Fourier coefficients is not a universally controlling use of the term.

In the Arguments page 8 lines 14-31 and page 9 lines 9-17, the appellant argues that the LMS algorithm discussed in MacFarlane col. 19 lines 16-22 is not in connection with the adjustment of filter coefficients, and argues that the LMS disclosure is tied to gain adjustment. This argument is not persuasive. The LMS disclosure is tied to adaptive signal processing algorithms for adjusting the filters to minimize errors. Further, Madsen already establishes the relationship between a minimization algorithm and filter coefficients; MacFarlane then reveals

that a least mean squares algorithm and a least squares algorithm are alternatives for minimizations.

In the Arguments page 9 lines 29-31, the appellant argues that there is no suggestion in Madsen or MacFarlane to adjust coefficients of a cascade of two-port all-pass filters using an LMS algorithm. Nevertheless, it would have been obvious to do so for the reason outlined in the rationale of the rejections. The appellant is directed MPEP § 2141.III, which explains rationales to support rejections under 35 USC § 103, and states: "The prior art reference (or references when combined) need not teach or suggest all the claim limitations, however, Office personnel must explain why the difference(s) between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art." [emphasis added]. In the rejections above under 35 USC § 103, a rationale is provided for why the difference(s) between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art.

In the Arguments, page 10 lines 10-12, the appellant argues that the complexity of implementing a two-port all-pass filter contradicts the examiner's contention that the combination is motivated by a desire to quickly and accurately compensate for dispersion. This argument is not persuasive. Whatever complexity may be involved in implementing a two-port all-pass filter, Madsen has already taken care of this by actually using one. The quick and accurate dispersion compensation mentioned in the rationale has to do with the reason why the minimization algorithm *already disclosed* by Madsen is used. In other words, the minimization function already disclosed by Madsen makes for quick

and accurate dispersion compensation. The LMS minimization algorithm is an alternative minimization algorithm to the one already disclosed, and so it could be used for the same reasons as the original.

In the Arguments page 10 lines 16-22, the appellant argues that the information known to those of ordinary skill in the art teaches away from the present invention. This argument is not persuasive. The appellant doesn't point here to any particular prior art as evidence of a teaching away, so the appellant is apparently referring again to the previous argument that LMS algorithms are for FIR and/or single channel filters, which has already been shown to be unpersuasive.

In the Arguments, page 11 lines 26-28, the appellant argues that Eyal doesn't teach reducing PMD using a cascade of two-port all-pass filters. This argument is not persuasive because Madsen already discloses reducing PMD using a cascade of two-port all-pass filters. There is no requirement for Eyal to provide a duplicate teaching.

In the Arguments, page 11 line 29 to page 13 line 17, the appellant presents arguments related to the Newton algorithm using the same reasoning that was used for the arguments related to the LMS algorithm. Since the reasoning was already addressed for the LMS case and found to be unpersuasive, these repeat arguments for the Newton case are also unpersuasive.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/NATHAN M CURS/

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